CLAIMS

1. A method of object detection comprising the steps of:

receiving images of an area occupied by at least one object;

extracting image features including wavelet features from the images; and

performing classification on the image features as a group in at least one common classification algorithm to produce object class confidence data.

2. The method of claim 1, wherein the object class confidence data includes a detected object estimate.

3. The method of claim 2, wherein the at least one object comprises a vehicle occupant and the area comprises a vehicle occupancy area, and further comprising a step of processing the detected object estimate to provide signals to vehicle systems.

4. The method of claim 3, wherein the signals comprise airbag enable and disable signals.

5. The method of claim 4, wherein the method further comprises a step of capturing images from a sensor selected from a group consisting of CMOS vision sensors and CCD vision sensors.

6. The method of claim 1, wherein the at least one common classification algorithm comprises a plurality of common classification algorithms.

7. The method of claim 6, comprising the further step of performing a mathematical function on the object class confidence data from

each of the common classification algorithms to thereby arrive at a detected object estimate.

8. The method of claim 6, comprising the further step of averaging the object class confidence data from each of the common classification algorithms to thereby arrive at a detected object estimate.

9. The method of claim 6, wherein each of the common classification algorithms has at least one different parameter value.

10. The method of claim 1, wherein said at least one common classification algorithm is selected from the group consisting of a Feedforward Backpropagation Neural Network, a trained C5 decision tree, a trained Nonlinear Discriminant Analysis network, and a trained Fuzzy Aggregation Network.

11. The method of claim 1, wherein the step of extracting image features comprises the step of extracting wavelet coefficients of the images of the at least one object occupying an area; and wherein the step of classifying the image features comprises processing the wavelet coefficients with said at least one common classification algorithm.

12. The method of claim 1, wherein the step of extracting image features further comprises the steps of:

detecting edges of the at least one object within the images;

masking the edges with a background mask to find important edges;

calculating edge pixels from the important edges; and

producing edge density maps from the important edges, the edge density map providing the image features, and wherein the step of classifying the image features comprises processing the edge density map with the at least

one common classification algorithm.

13. The method of claim 1, wherein the step of extracting image features further comprises the steps of:

receiving a stereoscopic pair of images of an area occupied by at least one object;

detecting pattern regions and non-pattern regions within each of the pair of images using a texture filter;

generating an initial estimate of spatial disparities between the pattern regions within each of the pair of images;

using the initial estimate to generate a subsequent estimate of the spatial disparities between the non-pattern regions based on the spatial disparities between the pattern regions using disparity constraints;

iteratively using the subsequent estimate as the initial estimate in the step of using the initial estimate to generate a subsequent estimate in order to generate further subsequent estimates of the spatial disparities between the non-pattern regions based on the spatial disparities between the pattern regions using the disparity constraints until there is no change between the results of subsequent iterations, thereby generating a final estimate of the spatial disparities; and

generating a disparity map of the area occupied by at least one object from the final estimate of the spatial disparities, and wherein the step of performing classification on the image features comprises processing the disparity map with the at least one classification algorithm to produce object class confidence data.

14. The method of claim 1, further comprising the steps of:

detecting motion of the at least one object within the images;

calculating motion pixels from the motion; and

producing motion density maps from the motion pixels, the motion density map providing the image features; and wherein the step of

classifying the image features comprises processing the motion density map with the at least one classification algorithm to produce object class confidence data.

15. The method of claim 1, wherein the receiving step comprises receiving a stereoscopic pair of images of an area occupied by at least one object, the extracting step including extracting image features from the images, with at least a portion of the image features being extracted by the steps of:

detecting pattern regions and non-pattern regions within each of the pair of images using a texture filter;

generating an initial estimate of spatial disparities between the pattern regions within each of the pair of images;

using the initial estimate to generate a subsequent estimate of the spatial disparities between the non-pattern regions based on the spatial disparities between the pattern regions using disparity constraints;

iteratively using the subsequent estimate as the initial estimate in the step of using the initial estimate to generate a subsequent estimate in order to generate further subsequent estimates of the spatial disparities between the non-pattern regions based on the spatial disparities between the pattern regions using the disparity constraints until there is no change between the results of subsequent iterations, thereby generating a final estimate of the spatial disparities; and

generating a disparity map of the area occupied by at least one object from the final estimate of the spatial disparities.

16. A computer program product for object detection, the computer program product comprising means, stored on a computer readable medium, for:

receiving images of an area occupied by at least one object;

extracting image features including wavelet features from the images; and

performing classification on the image features as a group in at least one common classification algorithm to produce object class confidence data.

17. A computer program product for object detection as set forth in claim 16, wherein the means for performing classification on the image features as a group comprises a means for processing the image features with at least one classification algorithm, said at least one common classification algorithm being selected from the group consisting of a Feedforward Backpropagation Neural Network, a trained C5 decision tree, a trained Nonlinear Discriminant Analysis network, and a trained Fuzzy Aggregation Network.

18. A computer program product for object detection as set forth in claim 16, wherein the means for extracting image features comprises a means for extracting wavelet coefficients of the at least one object in the images, and wherein the means for classifying the image features comprises a means for processing the wavelet coefficients with the at least one classification algorithm, at least one of the classification algorithms being selected from the group consisting of a Feedforward Backpropagation Neural Network, a trained C5 decision tree, a trained Nonlinear Discriminant Analysis network, and a trained Fuzzy Aggregation Network.

19. A computer program product for object detection as set forth in claim 18, wherein the means for extracting image features further comprises means for:

detecting edges of the at least one object within the images;

masking the edges with a background mask to find important edges;

calculating edge pixels from the important edges; and

producing edge density maps from the important edges, the edge density map providing the image features, and wherein the means for classifying the image features processes the edge density map with the at least one classification algorithm to produce object class confidence data.

20. A computer program product for object detection as set forth in claim 19, wherein the means for extracting image features further comprises means for:

receiving a stereoscopic pair of images of an area occupied by at least one object;

detecting pattern regions and non-pattern regions within each of the pair of images using a texture filter;

generating an initial estimate of spatial disparities between the pattern regions within each of the pair of images;

using the initial estimate to generate a subsequent estimate of the spatial disparities between the non-pattern regions based on the spatial disparities between the pattern regions using disparity constraints;

iteratively using the subsequent estimate as the initial estimate in the means for using the initial estimate to generate a subsequent estimate in order to generate further subsequent estimates of the spatial disparities between the non-pattern regions based on the spatial disparities between the pattern regions using the disparity constraints until there is no change between the results of subsequent iterations, thereby generating a final estimate of the spatial disparities; and

generating a disparity map of the area occupied by at least one object from the final estimate of the spatial disparities, and wherein the means for classifying the image features processes the disparity map with the at least one classification algorithm to produce object class confidence data.

21. An apparatus for object detection comprising a computer system including a processor, a memory coupled with the processor, an input coupled with the processor for receiving images, and an output coupled with the processor for outputting information based on an object estimation, wherein the computer system further comprises means, residing in its processor and memory, for:

receiving images of an area occupied by at least one object;

extracting image features including wavelet features from the images; and

performing classification on the image features as a group in at least one common classification algorithm to produce object class confidence data.

22. An apparatus for object detection as set forth in claim 21, wherein the means for classifying image features comprises a means for processing the image features with the at least one classification algorithm, the at least one classification algorithm being selected from the group consisting of a Feedforward Backpropagation Neural Network, a trained C5 decision tree, a trained Nonlinear Discriminant Analysis network, and a trained Fuzzy Aggregation Network.

23. An apparatus for object detection as set forth in claim 21, wherein means for extracting image features comprises a means for:

extracting wavelet coefficients of the at least one object in the images; and

wherein the means for classifying the image features comprises processing the wavelet coefficients with the at least one classification algorithm to produce object class confidence data, the at least one classification algorithm being selected from the group consisting of a Feedforward Backpropagation Neural Network, a trained C5 decision tree, a trained Nonlinear Discriminant Analysis network, and a trained Fuzzy Aggregation Network.

24. An apparatus for object detection as set forth in claim 23, wherein the means for extracting image features further comprises means for:

detecting edges of the at least one object within the images;

masking the edges with a background mask to find important edges;

calculating edge pixels from the important edges; and

producing edge density maps from the important edges, the edge density map providing the image features;

wherein the means for classifying the image features processes the edge density map with at least one of the classification algorithms to produce object class confidence data; and

wherein the means for extracting image features further comprises means for:

receiving a stereoscopic pair of images of an area occupied by at least one object;

detecting pattern regions and non-pattern regions within each of the pair of images using a texture filter;

generating an initial estimate of spatial disparities between the pattern regions within each of the pair of images;

using the initial estimate to generate a subsequent estimate of the spatial disparities between the non-pattern regions based on the spatial disparities between the pattern regions using disparity constraints;

iteratively using the subsequent estimate as the initial estimate in the means for using the initial estimate to generate a subsequent estimate in order to generate further subsequent estimates of the spatial disparities between the non-pattern regions based on the spatial disparities between the pattern regions using the disparity constraints until there is no change between the results of subsequent iterations, thereby generating a final estimate of the spatial disparities; and

generating a disparity map of the area occupied by at least one object from the final estimate of the spatial disparities, and wherein the means for classifying the image features processes the disparity map with the at least one classification algorithm to produce object class confidence data.

25. An apparatus for object detection as set forth in claim 23, wherein the means for extracting image features further comprises means for:

receiving a stereoscopic pair of images of an area occupied by at least one object;

detecting pattern regions and non-pattern regions within each of the pair of images using a texture filter;

generating an initial estimate of spatial disparities between the pattern regions within each of the pair of images;

using the initial estimate to generate a subsequent estimate of the spatial disparities between the non-pattern regions based on the spatial disparities between the pattern regions using disparity constraints;

iteratively using the subsequent estimate as the initial estimate in the means for using the initial estimate to generate a subsequent estimate in order to generate further subsequent estimates of the spatial disparities between the non-pattern regions based on the spatial disparities between the pattern regions using the disparity constraints until there is no change between the

results of subsequent iterations, thereby generating a final estimate of the spatial disparities; and

generating a disparity map of the area occupied by at least one object from the final estimate of the spatial disparities, and wherein the means for classifying the image features processes the disparity map with the at least one classification algorithm to produce object class confidence data.

26. An apparatus for object detection as set forth in claim 21, wherein the computer system further comprises means, residing in its processor and memory, for:

receiving a stereoscopic pair of images of an area occupied by at least one object;

extracting image features from the images, with at least a portion of the image features being extracted by means for:

detecting pattern regions and non-pattern regions within each of the pair of images using a texture filter;

generating an initial estimate of spatial disparities between the pattern regions within each of the pair of images;

using the initial estimate to generate a subsequent estimate of the spatial disparities between the non-pattern regions based on the spatial disparities between the pattern regions using disparity constraints;

iteratively using the subsequent estimate as the initial estimate in the means for using the initial estimate to generate a subsequent estimate in order to generate further subsequent estimates of the spatial disparities between the non-pattern regions based on the spatial disparities between the pattern regions using the disparity constraints until there is no change between the results of subsequent iterations, thereby generating a final estimate of the spatial disparities; and

generating a disparity map of the area occupied by at least one object from the final estimate of the spatial disparities; and

performing classification on the image features as a group in at least one common classification algorithm to produce object class confidence data, with at least a portion of the classifying being performed by processing the disparity map with the at least one classification algorithm to produce object class confidence data.